Stanford University

Asteroid surface resource characterization through distributed plasma analysis of meteoroid impact ejecta

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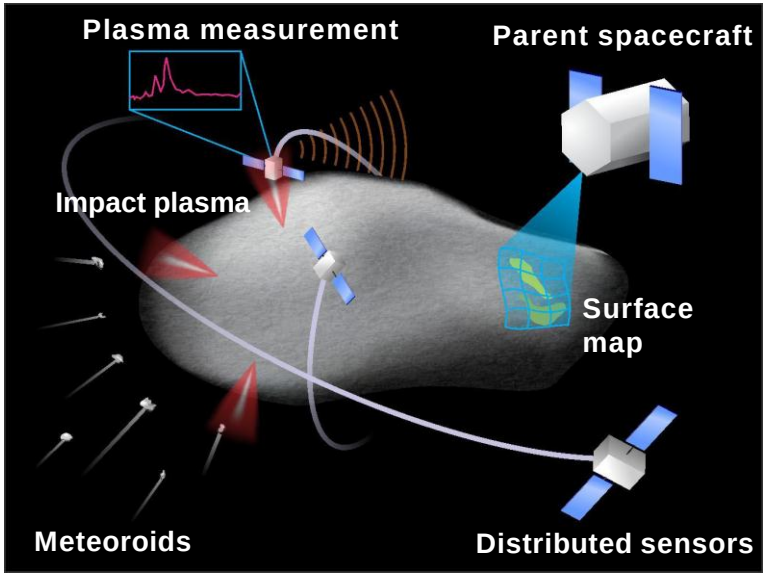
Research Objectives

Goals:
- Independent method of asteroid surface resource characterization
- Enable molecular discrimination, rapid coverage, and improved spatial resolution

Innovation:
- Leverage meteoroid impacts to yield measurement of surface composition through plasma formation



Start TRL: 1 (basic impact plasma formation principles studied in lab/simulation)
End TRL: 3 (analytical study of asteroid resource characterization system, proof-of-concept lab studies of sensor technologies

Approach

1. Plasma evolution model
- Numerical simulation
- Couple existing meteoroid flux data to expected plasma environment near asteroid

2. Plasma sensor development
- Parametric sensor analysis and design in simulation
- Experimental deployment study
- Experimental performance characterization

3. Asteroid map generation
- Apply map estimation techniques to generate surface map derived from plasma evolution model
- Produce map using synthetic asteroid/plasma data in simulation
- Integrate plasma sensor characteristics

Potential Impact

Direct benefits:
- Lower power/volume/cost resource characterization method to complement spectroscope for asteroid ISRU
- Extend capabilities of small spacecraft systems

Future benefits:
- Additional measurements of deep space meteoroid flux for mission safety
- Enable study of deep space meteoroid and asteroid environment to inform origins of solar system
- Improved characterization of zodiacal light (dust) contamination for CMB observations